

# EXHIBIT 4

UNITED STATES DISTRICT COURT  
FOR THE SOUTHERN DISTRICT OF MISSISSIPPI  
JACKSON DIVISION

LATOYA BROWN; LAWRENCE  
BLACKMON; HERBERT ANTHONY  
GREEN; KHADAFY MANNING;  
QUINNETTA MANNING; MARVIN  
MCFIELD; NICHOLAS SINGLETON;  
STEVEN SMITH; BESSIE THOMAS;  
and  
BETTY JEAN WILLIAMS TUCKER,  
individually and on behalf of a class of all  
others similarly situated,

Civil Action No.  
3:17-cv-00347-WHB-LRA

*Plaintiffs,*

v.

MADISON COUNTY, MISSISSIPPI;  
SHERIFF RANDALL S. TUCKER, in his  
official capacity; and MADISON  
COUNTY  
SHERIFF'S DEPUTIES JOHN DOES #1  
through #6, in their individual capacities,

*Defendants.*

**REBUTTAL EXPERT REPORT OF JUSTIN MCCRARY, Ph.D.**

July 2, 2018

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## 1. QUALIFICATIONS AND ASSIGNMENT

### 1.1. *Qualifications*

1. I am an economist with expertise in economic modeling, statistical methods, and law and economics, among other subjects. I received my A.B. in Public Policy from Princeton University in 1996. After working at National Economics Research Associates in White Plains, New York, and the Federal Reserve Bank of New York from 1996 to 1998, I began my Ph.D. in Economics at the University of California, Berkeley (“Berkeley”), completing the degree in June 2003. After close to five years as Assistant Professor at the University of Michigan (“Michigan”), I became Assistant Professor of Law at Berkeley in January 2008 and was promoted to Professor in July 2010, a position I hold today. While at Berkeley, I have taught courses on introductory, intermediate, and advanced statistics to J.D., L.L.M., and Ph.D. students; on law and economics to J.D. students as well as undergraduates; on labor economics to Ph.D. students in economics and in other fields; and on business law to J.D., L.L.M., and M.B.A. students. In Fall 2017, I took leave from Berkeley and assumed a position as the Samuel Rubin Visiting Professor of Law at the law school of Columbia University (“Columbia”), and effective July 2018, I will join the Columbia law faculty on a permanent basis as the Paul J. Evanson Professor of law. At Columbia, I will teach corporations, antitrust, economics, and statistics.
2. While at Berkeley, I served as the Founding Director of D-Lab, the Social Sciences Data Laboratory at Berkeley, from July 2014 to June 2017, at which point I stepped down to visit Columbia. D-Lab trains graduate students in statistical and data science techniques relevant to modern computation and modern data collections. In addition, the D-Lab archives major data collections, such as those associated with the Census Research Data Centers, the financial market, birth certificate data, and other large-scale collections of import. At D-Lab, I lectured and advised graduate students and faculty regarding high-performance and high-throughput computing, statistical software, and statistical and econometric techniques, including methods for inferring causality from observational data.
3. From September 2009 until July 2014, when I began to direct the D-Lab, I co-directed the Law and Economics Program at Berkeley Law. Since 2017, I have been a member of the Board of Directors of the American Law and Economics Association.

4. Since 2008, I have co-directed the Economics of Crime Working Group of the National Bureau of Economic Research (“NBER”). The NBER is the preeminent professional association of economists in the world, with over 1,400 members worldwide. I was invited to become a Faculty Research Fellow of the NBER in 2006 and remained in that position until 2012, when I was invited to become a Faculty Research Associate, a position I hold today. In my role as co-Director of the Economics of Crime Working Group, I annually review emerging research on criminal enterprises, deterrence theory, and related issues, selecting the best papers on the subject for presentation at conference, and I propose younger scholars for entry to the NBER.
5. As noted, I previously worked at Michigan. From 2003 through 2007, I was Assistant Professor of Public Policy and Assistant Professor of Economics. While at Michigan, I taught introductory statistics and advanced microeconomic theory to M.P.P. students, and advanced econometric theory to Ph.D. students.
6. My research spans a diverse range of topics, including econometric and statistical methodology, crime, employment discrimination, income inequality, education, antitrust, fertility, financial markets, and monetary policy. I have published 18 papers, many of them in leading journals within economics, such as the *American Economic Review*, the *Review of Economics and Statistics*, the *Journal of Economic Literature*, and the *Journal of Econometrics*. According to Google Scholar, six of my papers have been cited over 100 times in the academic literature, with one of those papers, entitled “Manipulation of the Running Variable in the Regression Discontinuity Design” and published in the *Journal of Econometrics*, having been cited over 2,000 times. In addition to my published papers, I am a co-editor of the book *Controlling Crime: Strategies and Tradeoffs*, published by the University of Chicago Press.
7. Over the years, my research has been supported by Michigan, Berkeley, the MacArthur Foundation, the NBER, the National Institutes of Health, the National Science Foundation, the Arnold Foundation, the Spencer Foundation, and the Robert Wood Johnson Foundation.
8. I regularly review articles for the leading peer reviewed journals within economics, including *Econometrica*, the *American Economic Review*, the *Quarterly Journal of Economics*, the *Journal of Political Economy*, the *Review of Economic Studies*, the *Journal of Econometrics*, the *Review of Economics and Statistics*, and the *American*

*Law and Economics Review.* Peer review specifically focuses on assessing whether submitted manuscripts are employing methodologies that are consistent with academic standards.

9. My consulting experience spans a wide range of industries and markets. For example, I have previously analyzed the extent to which alleged collusive behavior among health care providers affected prices; the extent of infringing sales in a patent lawsuit pertaining to pharmaceuticals; the potential anti-competitive implications of a proposed telecommunications merger; damages associated with an alleged price-fixing conspiracy in the corrugated packaging industry; damages associated with an alleged price-fixing conspiracy in several prominent high-technology product markets; and damages associated with an alleged price-fixing conspiracy in the sale of retail gasoline.
10. In addition to work as a consultant for companies, I often provide consulting for state, local, and federal government, frequently on a *pro bono* basis. Many of these engagements revolve around quantifying the benefits of safety investments, or the extent of differences between racial or ethnic groups, such as differences in income, employment, or arrest rates. All of these engagements have involved the study and use of economics, econometrics, and statistics.
11. Finally, I am frequently invited to give talks regarding the utilization of statistical methodologies in empirical legal studies and from 2011–2015 gave day-long lectures for the annual *Causal Inference Workshop*, as well as its more advanced version, the *Advanced Causal Inference Workshop*. This Spring, I will again participate in the *Causal Inference Workshop*.
12. A copy of my curriculum vitae, including a list of previous testimony and depositions, is included as Appendix A. I am doing this work on a *pro bono* basis. I have been assisted in this matter by staff of Cornerstone Research, who worked under my direction.

## **1.2. Assignment**

13. I have been asked by counsel for Plaintiffs to review the reports of Dr. Steward and Dr. Ricchetti, and comment on Dr. Steward’s claim that Dr. Ricchetti’s methodology is not a widely-accepted methodology in the academic literature on the economics of crime.

14. As part of my own academic research, I am the co-Director of the Economics of Crime Working Group for the National Bureau of Economic Research, where I annually review emerging empirical research on crime, economics, and related issues, selecting the best papers on the subject for presentation at conference, and I propose younger scholars for entry to the NBER. I have also written extensively on the economics of crime and the statistical methodologies used to analyze the relationship between crime and other factors, including a recently published paper that is the lead article in the *Journal of Economic Literature* summarizing numerous papers that use statistical methods to explore a variety of questions related to crime. I have also written extensively on statistical methods used to analyze outcomes across race. Thus, I have in-depth expertise on the methodologies used in this field.
15. As I explain below, the methods Dr. Ricchetti uses are widely accepted in the academic literature and by Courts. Dr. Steward's claims about the literature are misleading, inaccurate, and reveal a misunderstanding of standard methodological issues.

## 2. USING GEOGRAPHIC DATA TO TEST HOW OUTCOMES VARY BY RACE ACROSS DIFFERENT NEIGHBORHOODS IS WIDELY ACCEPTED IN THE ACADEMIC LITERATURE AND BY COURTS

16. Dr. Ricchetti's report uses a regression methodology that is standard in the academic literature. Specifically, Dr. Ricchetti analyzes how roadblock frequency varies in neighborhoods of differing racial composition, while controlling for DUI and traffic citations of drivers in each area. As I explain below, this type of regression analysis – in which a researcher analyzes differences in outcomes across geographic areas to understand how different demographic and economic factors affect those outcomes – is one of the most widely used research methods in economics and statistics.
17. Despite the fact that Dr. Ricchetti uses such a standard and widely-accepted methodological approach, Dr. Steward asserts that Dr. Ricchetti's methodology is inconsistent with the academic literature and not reliable. As I explain below, Dr. Steward's assertions misunderstand basic econometric principles and misrepresent the academic literature. Dr. Steward's claims can be organized into two categories, which I address in turn below.

### ***2.1. Dr. Steward appears to misunderstand the purpose of Dr. Ricchetti's measure of race, and mischaracterizes his methodology***

18. First, Dr. Steward argues that Dr. Ricchetti's use of the share of population that is African-American in a given census tract is not reliable because the share of population in a community that is African-American is not a reliable measure of the share of drivers in a community who are African-American.<sup>1</sup> While I agree with Dr. Steward that controlling for driving behavior is important in an analysis of

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<sup>1</sup> Rebuttal Expert Report of Dwight D. Steward, Ph.D. RE: Bryan Ricchetti, Ph.D., May 8, 2018 (“Steward Report”), ¶¶ 39–40 (“[I]t is generally acknowledged in the police racial profiling research literature that the residential population in a given area is not an appropriate measure of the driving population in these types of settings. Further, these studies generally do not indicate that police racial profiling bias can be expected to occur at some specific racial population percentage level as Dr. Ricchetti assumes in his analysis. Dr. Ricchetti appears to be developing some type of new police racial bias theory or is applying the existing racial profiling literature in some novel and untested manner.... In my 19 years of professional experience with working in this area of research, I have not seen police racial bias analysis performed in the manner that Dr. Ricchetti does in his report.”). Steward Report ¶, 47 (“It is generally recognized that the driving population on a given road can vary from the residential population in the area of the road for any number of reasons. Commercial and retail activity frequently draws individuals onto area roads that are demographically different from the persons who live in the residences surrounding the roads.”).

roadblocks, Dr. Steward's argument misunderstands and misrepresents Dr. Ricchetti's model.

19. I have reviewed Dr. Ricchetti's analysis and model. Dr. Ricchetti's model includes direct controls for drunk driving and traffic violations of *drivers* in each census tract. In other words, Dr. Ricchetti's model controls for the relevant behavior of drivers in each census tract. While Dr. Steward emphasizes the importance of DUIs in the establishment of roadblocks (calling it "the key factor"), Dr. Ricchetti's model controls for DUIs.<sup>2</sup> Thus, contrary to Dr. Steward's claims and consistent with the literature, Dr. Ricchetti controls for the relevant behavior of driving population in each census tract, given the focus on roadblock policing.
20. I do not understand Dr. Ricchetti's model's use of the share of African-Americans living in a census tract as a proxy for the share of drivers in that census tract that are African-American. Instead, Dr. Ricchetti's model uses the share of population that is African-American in each census tract to test of whether there are more roadblocks in some areas of the county than others, *controlling for driving behavior*.
21. This type of model, in which a researcher looks at differential policing across different neighborhoods based on racial breakdown of residents in the neighborhood while controlling for relevant crime in each neighborhood, has been used in both academic research and relied on by Courts. I am the author of a paper that surveys key papers in the economic and statistics literature on crime.<sup>3</sup> In that paper, I cite to a paper by Jeff Fagan and co-authors ("Fagan et al.") as an example that uses the same general type of model Dr. Ricchetti uses to assess whether the Stop, Question, and Frisk program in New York City (SQF) was used more heavily in minority neighborhoods, while controlling for crime levels.<sup>4</sup> As in Dr. Ricchetti's

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<sup>2</sup> See, for example, Steward Report, ¶ 11 ("... DUI activity and not race, is the key factor in MCSD traffic roadblock location placement."); Steward Report, ¶ 58 ("It my understanding that MCSD receives grant funding from Mississippi Office of Highway Safety (MOHS) in its efforts to reduce the incidents of drunk driving and to assist with cost of establishing DUI traffic roadblocks. It is my understanding that the grant funding is subject to periodic renewal and is contingent on satisfactory achievement of DUI enforcement. Even a cursory look at the traffic roadblock and CAD data shows that the DUI activity in a geographical area during a specific time period is correlated with an increased number of traffic roadblocks in the geographical area in later time periods.").

<sup>3</sup> Chalfin, Aaron, and Justin McCrary, "Criminal Deterrence: A Review of the Literature," *Journal of Economic Literature*, 55(1), 2017, pp. 5–48.

<sup>4</sup> Chalfin, Aaron, and Justin McCrary, "Criminal Deterrence: A Review of the Literature," *Journal of Economic Literature*, 55(1), 2017, pp. 5–48, at p. 21; Fagan, Jeffery A., et al., "Street Stops and Broken Windows Revisited: The Demography and Logic of Proactive Policing in a Safe and Changing City," Stephen K. Rice and Michael D. White

model, Fagan et al. examined whether the intensity of a particular type of policing effort varied across neighborhoods based on the racial distribution of *the residents* in that neighborhood, given the level of relevant crimes committed in those neighborhoods. Prof. Fagan and his co-authors have in fact published several articles using this broad methodology.<sup>5</sup> I also understand that Prof. Fagan's methodology was used in *Floyd et al. v. the City of New York* and the model was accepted by the Courts.<sup>6</sup> Such an approach can be (and, in this particular instance in my opinion, is) a methodologically appropriate approach to determine whether there is a statistically significant relationship between roadblock placement and the racial composition of a census tract, conditional on other factors.

22. More generally, the literature on crime and policing regularly leverages different levels of crime and policing across different geographic areas (cities, counties, etc.) to understand the relationships between crime, policing, and local characteristics of different geographic areas.<sup>7</sup> Dr. Ricchetti's general methodology of using differences across geographic areas to analyze a relationship between roadblocks, drunk driving, and other traffic offenses, and neighborhood characteristics employs an accepted methodology that is widely applied to many questions. For example, this general methodology broadly parallels that used in an article by Sarath Sanga on race and policing in Oakland in a leading peer review journal.<sup>8</sup>
23. The general model Dr. Ricchetti uses is also commonly employed to investigate how differences across neighborhoods affects a variety of different social, political, and economic outcomes. For example, the model is commonly used in studies examining voting patterns across localities. Typical of this approach is a recent paper by Elizabeth Cascio and Ebonya Washington examining the connection

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(Eds.), *Race, Ethnicity, and Policing: New and Essential Readings*, New York University Press, New York and London, 2009, pp. 309–348.

<sup>5</sup> See, for example, Gelman, Andrew, Jeffrey Fagan, and Alex Kiss, “An Analysis of the New York City Police Department’s ‘Stop-and-Frisk’ Policy in the Context of Claims of Racial Bias,” *Journal of American Statistical Association*, 109(479), 2007, pp. 813–823.

<sup>6</sup> Opinion and Order, *Floyd et al. v. the City of New York*, May 16, 2012 at pp. 6–7.

<sup>7</sup> For example, my paper with Aaron Chalfin summarizes a large academic literature that utilizes aggregate data at different geographic levels to analyze factors that contribute to different levels of crime and policing across different geographic areas. Some of those papers include control variables for demographic factors like race. Chalfin, Aaron, and Justin McCrary, “Criminal Deterrence: A Review of the Literature,” *Journal of Economic Literature*, 55(1), 2017, pp. 5–48.

<sup>8</sup> Sanga, Sarath, “Does Officer Race Matter?” *American Law and Economics Review*, 16(2), 2014, pp. 403–432, especially Section 6.

between the Voting Rights Act and redistribution of state funds (“Cascio and Washington”). This paper was published in another leading peer review journal, the *Quarterly Journal of Economics*.<sup>9</sup>

24. The type of regression used by Cascio and Washington is analogous to regression models involving controls for area racial composition in a vast array of voting rights cases. These cases are too numerous to mention here but are summarized in detail in *Quiet Revolution in the South*, a leading monograph published by one of the top academic presses in the world, the Princeton University Press (“Quiet Revolution”).<sup>10</sup> Quiet Revolution is also an important work of social science literature and draws upon the same type of regression analysis Dr. Ricchetti employs in his report.
25. The type of model Dr. Ricchetti uses is also a common model used for understanding how different economic outcomes differ across neighborhoods of differing racial composition. For example, area-level measures of racial composition are employed by David Card and Jesse Rothstein in a paper examining the empirical relationship between racial composition in census tracts and the black-white test score gap.<sup>11</sup> Ed Glaeser and David Cutler of Harvard used the same broad methodology to analyze how employment and school outcomes differ across census tracts with different degrees of racial segregation.<sup>12</sup> There is also a literature that uses the same methodology to analyze how mortgage lending outcomes vary with the racial composition of neighborhoods.<sup>13</sup>
26. I have three final comments on Dr. Ricchetti’s model. First, in my experience with the literature, a relative strength of Dr. Ricchetti’s model as applied to the context at hand is that it tests the relationship between race and law enforcement with respect to a relatively narrow policing activity that has a measurable objective that both

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<sup>9</sup> Cascio, Elizabeth U., and Ebonya Washington “Valuing the Vote: The Redistribution of Voting Rights and State Funds following the Voting Rights Act of 1965,” *Quarterly Journal of Economics*, 129(1), 2014, pp. 379–433, especially at pp. 389–393.

<sup>10</sup> Davidson, Chandler, and Bernard Grofman (Eds.), *Quiet Revolution in the South: The Impact of the Voting Rights Act, 1965-1990*, Princeton University Press, Princeton, NJ, 1994.

<sup>11</sup> Card, David, and Jesse Rothstein, “Racial Segregation and the Black-White Test Score Gap,” *Journal of Public Economics*, 91(11-12), 2007, pp. 2158–2184.

<sup>12</sup> Cutler, David M., and Edward L. Glaeser, “Are Ghettos Good or Bad?” *Quarterly Journal of Economics*, 112(3), 1997, pp. 827–872.

<sup>13</sup> Rougeau, Vincent D., and Keith N. Hylton, “Lending Discrimination: Economic Theory, Econometric Evidence, and the Community Reinvestment Act,” *The Georgetown Law Journal*, 85(237), 1996, pp. 237–294, at pp. 269–270, 277, 289.

experts generally agree upon – namely the reduction of unsafe driving. As noted above, Dr. Steward agrees that the objective of roadblocks is the reduction of unsafe driving and cites to documents in his own report to support this claim.<sup>14</sup> Further, both Dr. Steward and Dr. Ricchetti have access to data from the sheriff’s department tracking DUIs and other traffic offenses, and both have argued DUIs are the key factor that correlates with roadblocks. Often times in academic research on crime, the outcomes being analyzed have complex causal chains and not all data is available, making the conclusions that can be drawn relatively weaker than those Dr. Ricchetti is able to draw here.

27. Second, Dr. Steward claims that Dr. Ricchetti’s analysis somehow assumes that “police racial profiling bias can be expected to occur at some specific racial population percentage level.”<sup>15</sup> I have reviewed Dr. Ricchetti’s model, and I do not understand it to be making any such assumption. Dr. Ricchetti’s regression model simply analyzes the relationship between the share of population that is African-American in each census tract and roadblock frequency. I do not understand his analysis to impose assumptions regarding the form of any racial bias on the part of police. Dr. Steward’s claims on this point appear to stem from his misunderstanding of a set of descriptive statistics in Dr. Ricchetti’s first report. Dr. Ricchetti’s regression analysis – which is the formal statistical test of the relationship between race and roadblocks – imposes no such assumption.
28. Third, Dr. Steward criticizes the descriptive statistics section of Dr. Ricchetti’s report.<sup>16</sup> While it is true Dr. Ricchetti presents a set of summary statistics that identify what a statistician would call a “bi-modal distribution” of race across census tracts (i.e., the share of African-Americans in each census tract clusters around two levels – less than 25% or approximately 50% or more), Dr. Ricchetti’s use of summary statistics to describe relevant patterns in the data before running his full regression model is a common approach in nearly every academic paper that uses regression. Such statistics are not meant to be offered as a formal statistical test, as Dr. Steward claims, and instead provide relevant background regarding the variation in racial composition across census tracts before running a formal regression model.

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<sup>14</sup> Steward Report, ¶¶ 57–61.

<sup>15</sup> Steward Report, ¶ 39.

<sup>16</sup> Steward Report, ¶¶ 34–39.

## 2.2. Dr. Steward's claims about race and census tracts

29. The second criticism Dr. Steward offers of Dr. Ricchetti's use of geographic data is equally misplaced. Dr. Steward asserts that the fact that there is variation within each census tract in the share of the population that is African-American "further undercuts the reliability of his analyses."<sup>17</sup> This assertion by Dr. Steward reveals a basic misunderstanding of geographic data, is inconsistent with basic econometric methods used in a great many published papers, and is simply inaccurate.
30. As discussed above in Section 2.1, it is common for academic papers to use data aggregated to a geographic level (like a census tract) to analyze crime and policing, as well as different outcomes by race more generally. Multiple notable academic studies that have analyzed how the racial composition of a neighborhood affects economic outcomes use census tract data.<sup>18</sup> In fact, the U.S. Department of Housing and Urban Development ("HUD") developed a randomized social experiment in the 1990's (called Moving to Opportunity ("MTO")) to analyze the effect of moving from a relatively higher poverty neighborhood to a relatively lower poverty neighborhood on children's educational and economic outcomes.<sup>19</sup> The MTO study defined neighborhoods as census tracts, and the data from the MTO study has been analyzed by leading economists in top academic journals, including Raj Chetty and Larry Katz.<sup>20</sup>
31. Thus, the use of census tract level data – or county data, or city data, or state data – is common in academic research, and is in no way invalidated because the values of the variables vary within a census tract (or county, or city, or state) as Dr. Steward asserts. This feature of data is true for any variable that is measured at an aggregate geographic level, such as census tract, county, city, or state level. Consequently, statistical analyses comparing differences across neighborhoods in policing or any other outcome of interest can be a reliable methodology. Any conclusion to the contrary would be overly broad and incorrect. In fact, I understand Dr. Steward has

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<sup>17</sup> Steward Report, ¶ 46.

<sup>18</sup> Card, David, and Jesse Rothstein, "Racial Segregation and the Black-White Test Score Gap," *Journal of Public Economics*, 91(11-12), 2007, pp. 2158–2184; Cutler, David M., and Edward L. Glaeser, "Are Ghettos Good or Bad?" *Quarterly Journal of Economics*, 112(3), 1997, pp. 827–872. Both papers use census tracts.

<sup>19</sup> "Moving to Opportunity for Fair Housing," available at *U.S. Department of Housing and Urban Development*, <https://www.hud.gov/programdescription/mto>

<sup>20</sup> Chetty, Raj, Nathaniel Hendren, and Lawrence F. Katz, "The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment," *American Economic Review*, 106(4), 2016, pp. 855–902.

relied on comparisons of arrest data across geographic areas much bigger than census tracts in a benchmarking analysis in a prior matter where he served as the Plaintiff's expert.<sup>21</sup>

32. In fact, the use of aggregate data within a geographic unit is well understood to be a particular type of measurement error that does not create bias in favor of finding a statistically significant coefficient on race in a regression analysis. As I explain in more detail in the next section, if anything this type of measurement issue typically makes a model like Dr. Ricchetti's conservative.

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<sup>21</sup> Plaintiffs' Opposition to Defendants' Joint Motion to Exclude Dwight Steward, Ph.D., as an Expert Witness, *Kelly v. Paschall*, February 24, 2005.

### 3. MEASUREMENT ERROR IS A WELL-UNDERSTOOD FEATURE OF GEOGRAPHIC ANALYSIS THAT TYPICALLY MAKES AN ANALYSIS CONSERVATIVE

33. Dr. Steward points to two examples of a standard methodological issue in econometrics known as measurement error and suggests that such measurement errors render Dr. Ricchetti's analysis unreliable. As I describe below, Dr. Steward's arguments on these points are methodologically unsound, unsupported by the literature, and misunderstand measurement error and the associated statistical theory. I note that I have written specifically on the subject of measurement error in criminal justice and am familiar with the extensive literature on the subject.<sup>22</sup>

#### 3.1.1. *Measurement error in the number of roadblocks*

34. First, Dr. Steward claims that the fact that some of the roadblocks that Dr. Ricchetti analyzes occur on the boundary of census blocks makes it "difficult, if not impossible, to determine the level and direction of the errors that his faulty methodology introduces into his analysis,"<sup>23</sup> and that it "is unacceptable and unreasonable to assume that his errors will 'wash out' in the end."<sup>24</sup> Dr. Steward's statements are incorrect and methodologically unsound. In fact, in his deposition testimony, Dr. Steward appears to misunderstand the definition of measurement error.<sup>25</sup>

35. It is well understood in economics and statistics that nearly all data sources have imperfections in them that introduce the possibility of what economists refer to as measurement error.<sup>26</sup> Importantly, the effect of measurement error in a context such as that analyzed by Dr. Ricchetti is not to make analysis "impossible," but instead

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<sup>22</sup> Chalfin, Aaron, and Justin McCrary, "Are U.S. Cities Underpoliced? Theory and Evidence," *Review of Economics and Statistics*, 100(1), 2018, pp. 167–186.

<sup>23</sup> Steward Report, ¶ 32.

<sup>24</sup> Steward Report, ¶ 32.

<sup>25</sup> Deposition of Dwight Steward, Ph.D., June 22, 2018, pp. 186:17–187:10 ("Q. And what is your understanding of that term [measurement error]? A. Measurement error is not data error. Measurement error is a completely statistical term. And again, it has to do with a tool, not with the data. Measurement error just has to do with accounting for the fact that there are going to be some things you can't measure. The classic example is fire in the belly when you're looking at salary. You're going to have some people that work really hard and other people that don't really hard. But on average, when you're doing a salary analysis, it balances out.").

<sup>26</sup> Angrist, Joshua D., and Alan B. Krueger, "Empirical Strategies in Labor Economics," Orley C. Ashenfelter and David Card (Eds.), *Handbook of Labor Economics*, 1999, pp. 1277–1366, at pp. 1339–1340.

to make an analysis conservative. For example, a leading econometrics textbook notes the following:<sup>27</sup>

“The usual assumption is that the measurement error in [a dependent variable] is statistically independent of each explanatory variable. If this is true, then the OLS estimators [the regression coefficients] are unbiased and consistent. Further, the usual OLS inference procedures ( $t$ ,  $F$ ,  $LM$  statistics are valid)... measurement error in the dependent variable results in a larger variance than when no error occurs; this, of course, results in larger variances of the OLS estimators.... The bottom line is that, if the measurement error is uncorrelated with the independent variables, then OLS estimation has good properties.”

36. As described in the above quote, the existence of measurement error in the dependent variable (the issue Dr. Steward focuses on) typically has *no effect* on the reliability of a regression model. The only effect of measurement error is to increase the variance of the model, which makes it *harder* to find a statistically significant effect for any variable in the model. Thus, to the extent there is measurement error in Dr. Ricchetti’s model, the statistical significance of the race variable is conservative.
37. One way in which the measurement error Dr. Steward identifies could conceivably change Dr. Ricchetti’s findings is if the roadblocks on boundaries were systematically mis-assigned to census tracts in a very specific way that correlated, after controlling for the other covariates in his model, with census tract racial composition.<sup>28</sup> Importantly, there are standard ways to test for such a concern. For example, one way to test for such a concern is to run robustness tests that exclude from the model any data points in which measurement error might be a problem.<sup>29</sup>

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<sup>27</sup> Wooldridge, Jeffery M., *Introductory Econometrics: A Modern Approach*, 5th Edition, South-Western Cengage Learning, Mason, Ohio, 2012, pp. 318–319.

<sup>28</sup> Wooldridge, Jeffery M., *Introductory Econometrics: A Modern Approach*, 5<sup>th</sup> Edition, South-Western Cengage Learning, Mason, Ohio, 2012, p. 320 (“The bottom line of this subsection is that measurement error in the dependent variable *can* cause biases in OLS if it is systematically related to one or more of the explanatory variables. If the measurement error is just a random reporting error that is independent of the explanatory variables, as is often assumed, then OLS is perfectly appropriate.”).

<sup>29</sup> Rubinfeld, Daniel L., “Reference Guide on Multiple Regression,” *Reference Manual on Scientific Evidence*, 3<sup>rd</sup> Edition, Federal Judicial Center, the National Academies Press, Washington, D.C., 2011, p. 327 (“In general, it is important to explore the reasons for unusual data points. If the source is an error in recording data, the appropriate corrections can be made. If all the unusual data points have certain characteristics in common (e.g., they all are associated with a supervisor who consistently gives high ratings in an equal pay case), the regression model should be modified appropriately. One

Rather than use those standard tests, Dr. Steward simply asserts measurement error is a problem. Dr. Steward does not in any way *test* whether it affects Dr. Ricchetti's findings. Based on standard econometric conclusions, the expectation for this type of measurement error would in fact be for it to "wash out" in the analysis. Dr. Steward makes no attempt to demonstrate that his concern is well-founded. In my opinion, the type of measurement error Dr. Steward identifies is highly unlikely to affect Dr. Ricchetti's conclusions, except by making them somewhat conservative from a statistical perspective.

38. Further, and more practically, I have reviewed Dr. Ricchetti's rebuttal report, and understand that when he removes the roadblocks on or near boundaries (the roadblocks that could be subject to measurement error), his main findings are unchanged. Dr. Ricchetti also runs a sensitivity in which he moves all roadblocks on the boundary into the census tract they border with the lowest African-American share. This sensitivity directly tests Dr. Steward's concern that the relationship between roadblocks and African-American share that Dr. Ricchetti finds is driven entirely by how data points on the boundary are assigned to census tracts. Dr. Ricchetti's findings again remain unchanged despite this assumption. These types of sensitivities indicate that any measurement error introduced by the existence of roadblocks on boundaries is not driving Dr. Ricchetti's results.
39. More generally, in my professional experience publishing papers, serving as a referee, determining tenure for junior scholars, and writing on criminal justice from an empirical perspective, it is my view that the type of data issue that Dr. Steward highlights is present in some form in a great number of empirical analyses and that the presence of some form of imperfection in data does not on its own necessarily render such analyses scientifically unreliable. To argue that, because imperfections such as those that are present in the data Dr. Ricchetti employs, an analysis should not be conducted, or is unreliable, is not standard.

### 3.1.2. *Measurement error in the share of African-Americans by census tract*

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generally useful diagnostic technique is to determine to what extent the estimated parameter changes as each data point in the regression analysis is dropped from the sample."); Angrist, Joshua D., and Alan B. Krueger, "Empirical Strategies in Labor Economics," Orley C. Ashenfelter and David Card (Eds.), *Handbook of Labor Economics*, 1999, pp. 1277–1366, at p. 1347 ("Researchers have employed a variety of 'trimming' techniques to try to minimize the effects of observations that may have been misreported.").

40. As noted above, Dr. Steward also asserts that the fact that there is variation within each census tract in the share of the population that is African-American “further undercuts the reliability of his analyses.”<sup>30</sup> As discussed above in Section 2, there are a great number of academic papers that use data aggregated to a geographic level (like a census tract) to analyze crime and policing, as well as different outcomes by race. The use of census tract level data is in no way invalidated because the values of the variables vary within a census tract. This feature of data is true for any variable that is analyzed at a census tract, county, city, or state level. Dr. Steward is simply wrong that this aspect of Dr. Ricchetti’s analysis “undercuts [its] reliability.”
  
41. In fact, measurement error in a control variable (like the share of the population in a census tract that is African-American) is typically understood to make the estimate of a coefficient *smaller* than otherwise would be the case. In fact, and as noted, one of my published papers on crime and policing focuses specifically on how the presence of measurement error will understate the relationship between policing and crime. In that paper, I described the concern of measurement error in a predicting variable as follows:<sup>31</sup>

“An obvious way to improve the precision of police elasticities is to return to regression-based methods with appropriate controls, as in Marvell and Moody (1996), for example. Importantly, however, this type of approach has the potential to run afoul of the ‘iron law of econometrics,’ or the tendency of regression coefficients to be too small because of errors in the measurement of the variable of interest (Hausman 2001).”

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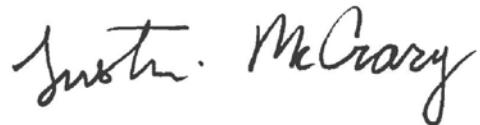
<sup>30</sup> Steward Report, ¶ 46.

<sup>31</sup> Chalfin, Aaron, and Justin McCrary, “Are U.S. Cities Underpoliced? Theory and Evidence,” *Review of Economics and Statistics*, 100(1), 2018, pp. 167–186.

#### 4. CONCLUSION

42. In sum, based on my review of Dr. Steward's and Dr. Ricchetti's reports, it is my view that Dr. Ricchetti's statistical model is a commonly-used and widely-accepted methodology in both the academic literature and by the Courts in litigation. Dr. Steward's claims to the contrary are simply not supported. In fact, as noted above, Dr. Steward has relied on the same methodology of comparing policing outcomes across different broad geographic regions himself in a prior case.
43. Additionally, Dr. Steward's claim that the existence of roadblocks on the boundary of census tracts renders Dr. Ricchetti's analyses unreliable is not correct. Dr. Steward's claims on this subject are contradicted by standard econometric methodology covered in basic textbooks, and by the large academic literature in economics and statistics on measurement error. Dr. Ricchetti's approach of using sensitivity analyses to test the potential effect of measurement error is a standard approach to this problem. The fact that Dr. Steward did not run any such tests to support his claims is not an accepted approach.

Executed on July 2, 2018



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Justin McCrary, Ph.D.

# Appendix A

## Justin McCrary

Columbia University  
School of Law  
632 Jerome Greene Hall  
New York, NY 10027

Cell Phone: (510) 409-6418  
Email: justin.mccrary@gmail.com  
Homepage: <http://econ.berkeley.edu/~jmccrary>

University of California, Berkeley  
School of Law  
586 Simon Hall  
Berkeley, CA 94708

### Current Appointments

2018– Columbia University  
Paul J. Evanson Professor of Law (effective July 1, 2018)

2010– University of California, Berkeley  
Professor of Law

2008–10 Assistant Professor of Law

2012– National Bureau of Economic Research  
Faculty Research Associate

2006–12 Faculty Research Fellow

### Past Appointments

Fall 2017 Columbia University  
Samuel Rubin Visiting Professor of Law

2014–17 University of California, Berkeley  
Director, Social Sciences Data Laboratory (D-Lab)

2003–07 University of Michigan  
Assistant Professor, Gerald R. Ford School of Public Policy

2003–07 Assistant Professor, Department of Economics (courtesy)

### Education

Ph.D. Economics, University of California, Berkeley, 2003

A.B. Public Policy, Princeton University, 1996

## Testimony Experience

*In Re: RFC and ResCap Liquidating Trust Litigation*

U.S. District Court for the District of Minnesota and

U.S. Bankruptcy Court for the Southern District of New York

Mortgage-backed securities case

Testimony regarding sampling, damages, and statistical concepts

Retained by Advanced Financial Services, BMO Harris Bank, Cadence Bank, Colonial Savings, CTX Mortgage, Decision One, First Guaranty, Freedom Mortgage, Home Loan Center, HSBC Mortgage, Impac Funding, PNC, Provident, Standard Pacific, Synovus, and Universal American

Report filed on June 15, 2018

Deposed on April 24, 2018

Rebuttal to supplemental disclosure filed on February 26, 2018

Rebuttal report filed on October 27, 2017

*Tri-City, LLC; Endor Car and Driver, LLC; Zehn-NY, LLC; Zwei-NY, LLC; Abatar, LLC; and Flatiron Transit, LLC v. New York Taxi and Limousine Commission and Meera Joshi*

Supreme Court of the State of New York, County of New York

Article 78 proceeding challenging an administrative ruling

Testimony regarding mismatch between accessibility regulation and accessibility demand

Retained by plaintiffs

Supplemental report filed on May 18, 2018

Affirmative report filed on April 13, 2018

*Federal Home Loan Bank of Boston, v. Ally Financial, Inc., et al.*

Superior Court of the State of Massachusetts, Business Litigation Session, Suffolk County

Mortgage-backed securities case

Testimony regarding sampling and statistical methods

Retained by Morgan Stanley

Rebuttal report filed on May 17, 2018

*Cheryl Phipps and Shawn Gibbons v. Wal-Mart Stores, Inc.*

United States District Court for the Middle District of Tennessee

Putative class action alleging discrimination in employment

Testimony regarding the decentralized nature of Walmart's internal labor market and concomitant heterogeneity across proposed class members in pay and promotion outcomes

Retained by Walmart

Deposed on April 30, 2018

Rebuttal report filed on April 20, 2018

*People of the State of California v. Morgan Stanley & Co.*

Superior Court of the State of California, County of San Francisco

Mortgage-backed securities case

Testimony regarding sampling and statistical methods

Retained by Morgan Stanley & Co.

Deposed on February 9, 2018

Rebuttal report filed on January 25, 2018

*Tony Dickey and Paul Parmer et al. v. Advanced Micro Devices, Inc.*  
U.S. District Court for the Northern District of California

Putative class action alleging false advertising

Testimony regarding availability of information regarding and market for computer chips and heterogeneity across putative class members

Retained by Advanced Micro Devices

Rebuttal report filed on January 26, 2018

*Martin Dulberg et al. v. Uber Technologies, Inc. and Rasier, LLC*  
U.S. District Court for the Northern District of California

Putative class action alleging breach of contract

Testimony regarding heterogeneity in damages across putative class members

Retained by Uber Technologies, Inc.

Affirmative report filed on January 11, 2018

*Federal Home Loan Bank of Chicago v. Banc of America Funding Corporation, et al.*  
Circuit Court of Cook County, Illinois, County Department, Chancery Division

Mortgage-backed securities case

Testimony regarding sampling, regression, and statistical methods

Retained by Morgan Stanley

Deposed on December 14, 2017

Rebuttal report filed on August 21, 2017

*In re Lehman Brothers Holdings, Inc., et al., Debtors*  
U.S. Bankruptcy Court for the Southern District of New York

Mortgage-backed securities case

Testimony regarding sampling, resampling methods for inference, and statistical methods

Retained by Lehman Brothers Holdings, Inc.

Deposed on October 9, 2017

Rebuttal report filed on August 28, 2017

*In re Gateway Plaza Residents Litigation*  
Supreme Court of the State of New York, County of New York

Putative class action regarding warranty of habitability

Testimony regarding electricity usage, individual preferences and choices, and heterogeneity across putative class members; large scale data analysis

Retained by Gateway Plaza

Class certification report filed on September 18, 2017

*Shamrell v. Apple Inc.*  
Superior Court of the State of California, County of San Diego

Putative class action regarding products liability, Unfair Competition Law and Consumers Legal Remedies Act

Testimony regarding heterogeneity across putative class members, failure rate methodologies, econometrics, and data science

Retained by Apple, Inc.

Class certification report filed on March 29, 2017

Rebuttal report filed on February 1, 2017

*Deutsche Bank National Trust Company v. Morgan Stanley Mortgage Capital Holdings LLC*  
U.S. District Court for the Southern District of New York

Mortgage-backed securities case

Testimony regarding sampling and statistical methods

Retained by Morgan Stanley Mortgage Capital Holdings LLC

Deposed on March 27, 2017

Rebuttal report filed on December 16, 2016

*Rosen v. Uber Technologies, Inc.*

U.S. District Court for the Northern District of California

Putative class action regarding false advertising

Testimony regarding economics of safety

Retained by Uber Technologies, Inc.

Deposed on February 3, 2017

Rebuttal report filed on January 13, 2017

Affirmative report filed on December 2, 2016

*Blackrock Allocation Target Shares: Series S Portfolio, et al., v. Wells Fargo Bank, N.A.; Royal Park Investments SA/NV v. Wells Fargo Bank, N.A., as Trustee; National Credit Union Administration Board, et al., v. Wells Fargo Bank, N.A.; Phoenix Light SF Limited, et al., v. Wells Fargo Bank, N.A.; and Commerzbank AG v. Wells Fargo Bank, N.A.*

U.S. District Court for the Southern District of New York

Mortgage-backed securities case

Testimony regarding sampling and statistical methods

Retained by Wells Fargo Bank

Report filed on January 18, 2017

*LA Taxi Cooperative, Inc. et al. v. Uber Technologies, Inc.*

U.S. District Court for the Northern District of California

False advertising case

Testimony regarding economics of safety

Retained by Uber Technologies, Inc.

Rebuttal report filed on January 13, 2017

Affirmative report filed on November 18, 2016

*State of Illinois v. Hitachi Ltd., et al.*

Circuit Court of Cook County, Illinois, County Department, Chancery Division

Antitrust price-fixing case

Testimony regarding liability and damages

Retained by Hitachi Ltd.

Report filed on November 11, 2016

*In re: City of San Bernardino, California, Debtor*

U.S. Bankruptcy Court, Central District of California, Riverside Division

Municipal bankruptcy case

Testimony regarding economics, econometrics, rare risks and the value of a statistical life

Retained by the City of San Bernardino

Report filed on October 3, 2016

*U.S. Bank National Association v. Morgan Stanley Mortgage Capital Holdings LLC*  
Supreme Court of the State of New York, County of New York

Mortgage-backed securities case  
Testimony regarding sampling and statistical methods  
Retained by Morgan Stanley Mortgage Capital Holdings LLC  
Deposed on September 10, 2016  
Report filed on June 17, 2016

*National Credit Union Administration Board v. RBS Securities, Inc.*  
U.S. District Court for the Central District of California &  
U.S. District Court for the District of Kansas

Mortgage-backed securities case  
Testimony regarding sampling and statistical methods  
Retained by RBS Securities  
Deposed on January 28, 2016  
Report filed on October 16, 2015

*Temple-Inland, Inc., v. Thomas Cook, et al.*  
U.S. District Court for the District of Delaware

Escheat law case  
Testimony regarding sampling, statistical methods, and economic theory  
Retained by the State of Delaware  
Deposed on November 24, 2015  
Report filed on October 23, 2015

*National Consumer Protection Service v. Farmacias Cruz Verde S.A. et al.*  
Honorable Civil Court of Santiago (Chile)

Antitrust putative class action  
Testimony regarding appropriate methods for estimating damages  
Retained by Salcobrand  
Report filed on November 14, 2015

*Douglas O'Connor, et al., v. Uber Technologies, Inc.*  
U.S. District Court for the Northern District of California

Putative class action regarding independent contractor versus employee  
Testimony regarding heterogeneity in alleged damages across putative class members, potential for class conflict  
Retained by Uber Technologies, Inc.  
Report filed on October 27, 2015  
Report filed on July 7, 2015

*Students for Fair Admissions, Inc. v. President and Fellows of Harvard College*  
U.S. District Court for the District of Massachusetts

Discovery dispute in affirmative action case  
Testimony regarding necessary inputs into statistical methodologies  
Retained by Harvard College  
Report filed on July 30, 2015

*Securities and Exchange Commission v. James V. Mazzo and David L. Parker*  
U.S. District Court for the Central District of California

Civil insider trading suit  
Testimony regarding probability theory and statistics  
Retained by James V. Mazzo and David L. Parker  
Deposed on May 13, 2015  
Report filed on March 13, 2015

*In re: City of Stockton, California, Debtor*  
U.S. Bankruptcy Court, Eastern District of California

Municipal bankruptcy suit  
Testimony regarding economic theory, labor economics, and econometrics  
Retained by the City of Stockton  
Deposed on March 13, 2013  
Report filed on February 15, 2013

*In the Matter of Act 111 Interest Arbitration Between Commonwealth of Pennsylvania and Pennsylvania State Troopers Association*

Hearings on wage setting  
Testimony regarding rare risks and the value of a statistical life  
Retained by the Pennsylvania State Troopers Association  
Testimony given on December 4, 2012  
Report filed on December 4, 2012

## Scholarship on Sampling, Statistics, and Econometrics

Conservative Tests Under Satisficing Models of Publication Bias (with Garret Christensen and Daniele Fanelli)  
*PLOS One*, Volume 11, Number 2, February 22, 2016

New Evidence on the Finite Sample Properties of Propensity Score Matching and Reweighting Estimators (with Matias Busso and John DiNardo)  
*Review of Economics and Statistics*, Volume 96, Number 5, December 2014

Incomes in South Africa Since the Fall of Apartheid (with Murray Leibbrandt and James Levinsohn)  
*Journal of Globalization and Development*, Volume 1, Issue 1, January 2010

Manipulation of the Running Variable in the Regression Discontinuity Design: A Density Test  
*Journal of Econometrics*, Volume 142, Issue 2, February 2008

## Scholarship on Risk and Crime

Are U.S. Cities Underpoliced? Theory and Evidence (with Aaron Chalfin)  
*Review of Economics and Statistics*, Volume 100, Issue 1, March 2018, 167–186

Criminal Deterrence: A Review of the Literature (with Aaron Chalfin)  
*Journal of Economic Literature*, Volume 55, Number 1, March 2017, 5–48 (lead article)

The Deterrence Effect of Prison: Dynamic Theory and Evidence (with David S. Lee)  
*Advances in Econometrics*, Volume 38, 2017

Do Sexually Violent Predator Laws Violate Double Jeopardy or Substantive Due Process: An Empirical Inquiry (with Tamara Lave)  
*Brooklyn Law Review*, Volume 78, Summer 2013, Number 4, 1391–1439

General Equilibrium Effects of Prison on Crime: Evidence From International Comparisons (with Sarath Sanga)  
*Cato Papers on Public Policy*, Volume 2, 2012

*Controlling Crime: Strategies and Tradeoffs* (co-edited with Phil Cook and Jens Ludwig), Chicago: University of Chicago Press, 2011.

## Scholarship on Competition

Measuring Benchmark Damages in Antitrust Litigation (with Daniel L. Rubinfeld)  
*Journal of Econometric Methods*, Volume 3, January 2014

## Scholarship on Finance

Dark Trading at the Midpoint: Pricing Rules, Order Flow, and Price Discovery (with Robert Bartlett)  
Accepted, *Journal of Law, Finance, and Accounting*

How Rigged Are Stock Markets?: Evidence from Microsecond Timestamps (working paper, 2016, with Robert Bartlett)

Shall We Haggle in Pennies at the Speed of Light or in Nickels in the Dark?: How Minimum Price Variation Regulates High Frequency Trading and Dark Liquidity (working paper, 2015, with Robert Bartlett)

## Scholarship on Labor Economics

Unmarked? Criminal Record Clearing and Employment Outcomes (with Jeffrey Selbin (lead author) and Joshua Epstein)

*Journal of Criminal Law and Criminology*, Volume 108, Number 1, 2017 (lead article)

The Effect of Female Education on Fertility and Infant Health: Evidence from School Entry Laws Using Exact Date of Birth (with Heather Royer)

*American Economic Review*, Volume 101, Number 1, February 2011

Comment on “Free to Punish? The American Dream and the Harsh Treatment of Criminals”, by Rafael di Tella and Juan Dubra

*Cato Papers on Public Policy*, Volume 1, 2011

Dynamic Perspectives on Crime

in *Handbook of the Economics of Crime*, Chapter 4, Edward Elgar, 2010

The Effect of Court-Ordered Hiring Quotas on the Composition and Quality of Police

*American Economic Review*, Volume 97, Number 1, March 2007

Using Electoral Cycles in Police Hiring to Estimate the Effect of Police on Crime: Comment

*American Economic Review*, Volume 92, Number 4, September 2002

## Other Scholarship

The Ph.D. Rises in American Law Schools, 1960-2011: What Does It Mean for Legal Education? (with Joy Milligan and James Phillips)

*Journal of Legal Education*, Volume 65, Number 543, Spring 2016

Following Germany’s Lead: Using International Monetary Linkages to Estimate the Effect of Monetary Policy on the Economy (with Julian di Giovanni and Till von Wachter)

*Review of Economics and Statistics*, Volume 91, Number 2, May 2009

## Other Activities

2017– Member, Board of Directors, American Law and Economics Association  
2014– Member, Quantitative Advisory Board, KOR Trading  
2008– Co-Director (with Phil Cook and Jens Ludwig), *Crime Working Group*, National Bureau of Economic Research  
2009–2014 Co-Director, *Law and Economics Program*, University of California, Berkeley

## Courses Taught

### *Columbia*

2017-2018 L6231-002: Corporations (Fall)

### *Berkeley*

2016-2017 Law 244.4: Litigation and Statistics (Fall); Law 216: Law and Economics Workshop (Fall); Law 218.6: Law and Economics of Discrimination (Fall)

2015-2016 Law 250: Business Associations (Fall); Law 244.4: Litigation and Statistics (Fall); Letters and Science 39D: Race, Policing, and Data Science (Fall)

2014-2015 Law 250: Business Associations (Fall); Law 250S: Business Associations (Summer)

2013-2014 Law 250S: Business Associations (Summer)

2012-2013 Law 250: Business Associations (Fall); Law 250S: Business Associations (Summer); Law 209.3: Introductory Statistics (Fall)

2011-2012 Law 250: Business Associations (Fall); Law 250S: Business Associations (Summer); Law 209.3: Introductory Statistics (Fall); Law 251.31: Introduction to Law, Economics, and Business (Spring); Legal Studies 145: Law and Economics I (undergraduate)

2010-2011 Law 250: Business Associations (Fall); Law 250S: Business Associations (Summer); Law 216: Law and Economics Workshop (Fall and Spring); Legal Studies 145: Law and Economics I (undergraduate); Law 209.6: Topic in Quantitative Methods (JSP); Econ 250C: Labor Economics (graduate, shared course with 209.6)

2009-2010 Law 216: Law and Economics Workshop (Fall and Spring); Law 209.32: Quantitative Methods II (JSP)

2008-2009 Legal Studies 145: Law and Economics I (undergraduate); Law 209.3: Quantitative Methods I (JSP); Law 209.32: Quantitative Methods II (JSP)

2007-2008 Legal Studies 145: Law and Economics I (undergraduate); Law 209.3: Quantitative Methods I (JSP)

### *Michigan*

Introduction to Quantitative Methods (policy), First Econometrics Field Course (economics), Advanced Economic Theory (policy)

## Grants and Fellowships

2007-2010 NIH, Constructive Proposals for Dealing With Attrition (with John DiNardo)

2009 Committee on Research, Junior Faculty Research Grant, UC Berkeley

2006-2009 NIH, The Effect of Female Education on Fertility and Infant Health (with Heather Royer, Grant # R03 HD051713)

2006–2011 NSF, New Instrumental Variables Estimates of the Effects of Schooling and Military Service: Empirical Strategies Using Non-Public-Use Data (with Josh Angrist and Stacey Chen)

2005 RWJ Foundation Health and Society Scholars Program, Small Grant Program

2004 Rackham Interdisciplinary Grant, University of Michigan

2004 CLOSUP Grant, University of Michigan

2004 National Poverty Center Grant, University of Michigan

2002–2003 Chancellor's Dissertation Year Fellowship, UC Berkeley

## Presentations

2017–2018 Columbia University, School of Law; Georgetown University, School of Law

2016–2017 George Mason University, School of Law; University of Michigan, Economics Department (Summer, Fall); Equities Leaders Summit; University of Zürich, Department of Economics; ETH (Swiss Federal Institute of Technology) Zürich, Law and Economics; Northwestern University, School of Law; Duke University, School of Law; Duke University, Information Initiative

2015–2016 Goldman Sachs; University of California, Berkeley, School of Law; University of Virginia, School of Law; University of California, Irvine; Equal Employment Opportunity Commission; National Bureau of Economic Research, Summer Institute

2014–2015 Duke University; Federal Reserve Bank of New York; Equal Employment Opportunity Commission (EEO-DataNet); American Law and Economics Association (discussant); New York University (NYU / Penn Law and Finance Conference); National Bureau of Economic Research, Summer Institute (discussant)

2013–2014 University of Southern California, School of Law; London School of Economics; Bank of Spain; CEMFI; Carlos III; University of Zaragoza; University of Rotterdam; University of Maastricht; University of Göteborg

2012–2013 University of California, Los Angeles, School of Law

2011–2012 University of Oregon, Department of Economics; University of British Columbia, Department of Economics; Brown University, Department of Economics; University of Rochester, Department of Economics; Cato Institute; National Bureau of Economic Research, Summer Institute; Harvard Law School

2010–2011 Northwestern, School of Law; University of Wisconsin, Department of Economics; Brookings Institution; Cato Institute

2009–2010 University of Chicago, School of Law; Cornell University, School of Law and Department of Economics; University of Michigan, School of Law and Department of Economics; University of Virginia, School of Law, Olin Conference

2008–2009 University of California, Los Angeles, School of Law; University of Arizona, School of Law and Department of Economics; Stanford University, School of Law and Department of Economics; University of Miami, Department of Economics

2007–2008 Northwestern University, School of Law; University of Michigan, Department of Economics; National Bureau of Economic Research, Summer Institute; Florida State University

*Prior to 2007–2008, presentations are at departments of economics, unless otherwise noted*

2006–2007 University of Michigan, Program in Survey Methodology; Public Policy Institute of California; Brown University

2005–2006 University of Michigan; University of California, Irvine; University of California, Santa Barbara; University of California, Santa Cruz; California State University, Long Beach; University of Western Ontario; University of Toronto; University of Illinois, Chicago; University of Chicago, Graduate School of Business; APPAM; University of Florida; University of California, Berkeley, School of Law; Princeton University; RAND; Hebrew University (conference in honor of Reuben Gronau); Stanford University, University of Wisconsin, Madison; Northwestern University; Crime and Economics Summer Workshop, University of Maryland

2004–2005 Federal Reserve Bank of Chicago; University of Illinois, Urbana-Champaign; University of Michigan, William Davidson Institute; University of Maryland; Urban Institute; American Economics Association Meetings; City University of New York Health Economics Seminar; University of Wisconsin, Madison; Stanford University; University of California, Davis; University of California, Berkeley, Labor Lunch; NBER Summer Institute, Education/Labor Studies

2003–2004 University of Michigan; APPAM; NBER Labor Studies Meeting (Fall); Massachusetts Institute of Technology; Harvard University, Kennedy School; University of California, Los Angeles; University of California, San Diego; Columbia University; University of California, Berkeley; NBER Summer Institute, Monetary Policy; NBER Summer Institute, Labor Studies

2002–2003 University of California, San Diego; University of California, Los Angeles; RAND Institute; University of Chicago, Graduate School of Business; University of Chicago, Harris School of Public Policy; University of Michigan, Ford School of Public Policy; Columbia University; Dartmouth College; Federal Reserve Bank of New York; Boston University

Last updated: June 16, 2018

**Documents Considered by Justin McCrary, Ph.D.****Legal Pleadings**

Opinion and Order, <i>Floyd et al. v. the City of New York</i>	May 16, 2012
Plaintiffs' Opposition to Defendants' Joint Motion to Exclude Dwight Steward, Ph D , as an Expert Witness, <i>Kelly v. Paschall</i>	February 24, 2005

**Expert Report**

Rebuttal Expert Report of Dwight D Steward, Ph D RE: Bryan Ricchetti, Ph D	May 8, 2018
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**Depositions**

Deposition of Dwight Steward, Ph D	June 22, 2018
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**Academic Literature**

Angrist, Joshua D , and Alan B Krueger, "Empirical Strategies in Labor Economics," <i>Orley C Ashenfelter and David Card (Eds ), Handbook of Labor Economics</i> , pp 1277–1366	1999
Card, David, and Jesse Rothstein, "Racial Segregation and the Black-White Test Score Gap," <i>Journal of Public Economics</i> , 91(11-12), pp 2158–2184	2007
Cascio, Elizabeth U , and Ebonya Washington "Valuing the Vote: The Redistribution of Voting Rights and State Funds following the Voting Rights Act of 1965," <i>Quarterly Journal of Economics</i> , 129(1), pp 379–433	2014
Chalfin, Aaron, and Justin McCrary, "Are U S Cities Underpoliced? Theory and Evidence," <i>Review of Economics and Statistics</i> , 100(1), pp 167–186	2018
Chalfin, Aaron, and Justin McCrary, "Criminal Deterrence: A Review of the Literature," <i>Journal of Economic Literature</i> , 55(1), pp 5–48	2017
Chetty, Raj, Nathaniel Hendren, and Lawrence F Katz, "The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment," <i>American Economic Review</i> , 106(4), pp 855–902	2016
Cutler, David M , and Edward L Glaeser, "Are Ghettos Good or Bad?" <i>Quarterly Journal of Economics</i> , 112(3), pp 827–872	1997
Davidson, Chandler, and Bernard Grofman, (Eds ), <i>Quiet Revolution in the South: The Impact of the Voting Rights Act, 1965-1990</i> , Princeton University Press, Princeton, NJ	1994
Fagan, Jeffrey A , et al , "Street Stops and Broken Windows Revisited: The Demography and Logic of Proactive Policing in a Safe and Changing City," Stephen K Rice and Michael D White (Eds ) <i>Race, Ethnicity, and Policing: New and Essential Readings</i> , New York University Press, New York and London, pp 309–348	2009
Gelman, Andrew, Jeffrey Fagan, and Alex Kiss, "An Analysis of the New York City Police Department's 'Stop-and-Frisk' Policy in the Context of Claims of Racial Bias," <i>Journal of American Statistical Association</i> , 109(479), pp 813–823	2007
Rougeau, Vincent D , and Keith N Hylton, "Lending Discrimination: Economic Theory, Econometric Evidence, and the Community Reinvestment Act," <i>The Georgetown Law Journal</i> , 85(237), pp 237–294	1996
Rubinfeld, Daniel L , "Reference Guide on Multiple Regression," <i>Reference Manual on Scientific Evidence</i> , 3 <sup>rd</sup> Edition, Federal Judicial Center, the National Academies Press, Washington, D C	2011
Sanga, Sarath, "Does Officer Race Matter?" <i>American Law and Economics Review</i> , 16(2), pp 403–432	2014
Wooldridge, Jeffery M , <i>Introductory Econometrics: A Modern Approach</i> , 5 <sup>th</sup> Edition, South-Western Cengage Learning, Mason, Ohio	2012

**Public Press/Websites**

"Moving to Opportunity for Fair Housing," available at *U.S. Department of Housing and Urban Development* , <https://www.hud.gov/programdescription/mto>